

# ERAC 7000

## ELECTRONIC RANDOM ACTION CONTROL

PATENT PENDING



ERAC 7000 energizes any device or group of devices in a completely random and unpredictable sequence.

### Two models are available:

Model S, which makes a random selection among a number of loads to be energized.

Model T, which energizes a single load randomly in time. The average repetition rate is adjustable.

### APPLICATIONS

AUTOMATIC-RANDOM SAMPLING

ADVERTISING SIGN CONTROL

ANIMATED DISPLAY CONTROL

AUTOMATIC TEXTILE DESIGN

PSYCHOLOGICAL TESTING

PHYSICAL TESTING

GENERATION OF RANDOM NUMBERS

AND MANY MORE

# SPECIFICATIONS

## MODEL S

NUMBER OF CONTROLLED OUTPUTS .....	10 (Standard)
LOAD CURRENT RATING .....	3 amperes*
LOAD VOLTAGE .....	up to 240 volts**
TOTAL CYCLING TIME .....	5 seconds***
"ON" TIME .....	3 seconds
"OFF" TIME .....	2 seconds
EXTERNALLY - PROGRAMMABLE .....	Manual or automatic by simple DPDT switching
SIZE .....	8-1/2 x 13 x 9"
WEIGHT .....	15 pounds (approximately)
DELIVERY .....	6 weeks

## MODEL T

NUMBER OF CONTROLLED OUTPUTS .....	1 (Standard)
LOAD CURRENT RATING .....	3 amperes*
LOAD VOLTAGE .....	up to 240 volts**
ADJUSTABLE AVERAGE REPETITION RATE .....	Maximum: 200 KC Minimum: Potentially unlimited
SIZE .....	8-1/2 x 13 x 9"
WEIGHT .....	15 pounds (approximately)
DELIVERY .....	6 weeks

\* up to 235 amperes rating available on special order.

\*\* up to 1100 volts available on special order.

\*\*\* special cycling sequences available including various combinations of "on" - "off" time and repeat cycles.

**TRAG AUTOMATIC SYSTEMS**

P.O. BOX 2101

DETROIT, MICHIGAN 48231

U.S.A.

Telephone: 837-5969 Area Code: 313

PRICES EFFECTIVE FEBRUARY, 1965  
MODEL S \$875.00 F.O.B. DETROIT  
MODEL T \$785.00 F.O.B. DETROIT



## SIMULATION OF RANDOM EVENTS

Many problems today in industry are solved by some type of simulation process, be it the simulation of certain variables in an analytical problem, or the simulation of environmental factors in a testing procedure. Many of the parameters are of a random nature. Using present techniques, these parameters are simulated in a cyclic manner, or at best, by a pre-programmed sequence which is so called random during its initial cycle. If a digital computer is available it can simulate these parameters by generating pseudo-random numbers by some mathematical artifice. These pseudo-random numbers also introduce appreciable error in the solutions. ERAC 7000, however, lends itself ideally to the simulation of random processes for it can generate true random numbers, either in a digital or decimal form. It avoids the forementioned errors involved with the other procedures and even if pseudo-random numbers can be tolerated in a particular application, the use of ERAC 7000 will not involve the necessity of a costly digital computer.

### TYPICAL APPLICATIONS:

- 1) Analytical Problems: It is desired to solve an industrial engineering problem involving game theory where the random variables are many and the effect of modifying these variables is desired without resorting to multiple run solution on a digital computer. ERAC 7000 can simulate any random variable with any probability average. The solution will be fast and efficient for one can immediately see the effect of any one parameter's variation on the solution.
- 2) Environmental Testing: It is desired to test a component in a critical application. One could, of course, simulate worst case conditions by having all random variables occurring concurrently during the test. This does not truly simulate actual conditions, and results in one of two problems:
  - a) The part fails under test. As a result another design is made to meet these extreme conditions. However, this second design may result in unnecessary costs if the particular part is not involved in the overall safety of the system in which it performs, since the probability of such extreme conditions occurring simultaneously are perhaps once per million years. This problem can also be carried further to the point that it prevents the functioning of the overall system since the newly designed part exceeds weight and/or space limitations which are quite critical in the aerospace industry, for example.
  - b) The part does not fail under test although "extreme" conditions have been met. It is a well known fact that although the majority of failures occur under extreme conditions, there are many failures that occur with certain critical combinations and critical sequence of parameters which are not always obvious to the quality control engineer. As a result we have a part which shows to have a satisfactory design by passing the extreme condition test but in actual random conditions the part would fail very quickly.

A satisfactory simulation test would involve simulating the actual random variables. Here again ERAC 7000 is an ideal tool for the simulation of these variables. It will result in a testing procedure which is true to actual conditions and does not resort to any oversimplification and distorted results.

TIME COMPRESSION: Is easily achieved in either the analytical simulation or physical simulation by proper scaling of the probability of the random parameters. If the actual probability of the parameter  $x$  is  $P_x$  then its compressed time probability  $P_x'$  will be equal to  $AP_x$  where  $A$  is the acceleration factor which is equal to the ratio of actual time to simulated time. Therefore any other parameter within the same system such as  $P_y$  will be simulated by a parameter  $P_y' = AP_y$ .

RELIABILITY: ERAC 7000 is a highly reliable device since all load switching is done by solid-state means.

FLEXIBILITY: ERAC 7000 is easily adapted to any type of random simulation. Program flexibility allows timing sequence to be changed within seconds.

GUARANTEE: TRAG AUTOMATIC SYSTEMS will service, free of charge, any defective units within one year after date of purchase if the control system has been used within the ratings specified, and no misuse or abnormal condition has been subjected to the instrument.

SPECIAL SYSTEMS: Special systems involving the simulation of several simultaneous random variables can be custom designed by TRAG AUTOMATIC SYSTEMS. Please send us your requirements for quotation.



## AUTOMATIC RANDOM SAMPLING

Most manufactured goods, whether they be castings or drugs, are tested in some manner before they are sold. Testing 100% of the items is very seldom used because of the high cost, and the slowing down of production, especially if multiple tests are required.

Therefore, random sampling is used in industry, resulting in fast, economical, and efficient quality control. However, all random sampling to date is done by some manual method, which often follows a certain cyclic pattern even though the person making the selection is not consciously aware of it. Some involving a direct manual selection, while others a tumbling process of the parts followed by a manual selection.

Most quality tests can be automated, however, the manual random sampling prevents the automation of the whole quality control operation. ERAC 7000 can make a completely automatic random selection as the manufactured items are produced. The average percentage of selection is adjustable thus allowing intensive control on a prototype process and a minimal control on a well-established product. Thus, the quality control operation can be fast, economical and completely automated if automatic tests are possible.

### EXAMPLES OF APPLICATIONS

- 1) Acceptance sampling - A manufacturer purchases a large number of small parts used in its product. Some type of quality control operation is usually applied to the lot shipped. Presently, an inspector will select a few parts at random from the top of the various containers shipped. However, this is a highly inaccurate method since the sample taken is a very poor representation of the population. A better approach would consist of random sampling the entire lot. However, using presently available techniques, this would be a slow and costly process. With ERAC 7000 a comprehensive sample of the whole lot can be taken quickly and efficiently by eliminating all manual sampling. The parts are fed to a selection station controlled by ERAC 7000 where a number of them are selected at random to be tested. The others are simply fed thru the selection station and stored in an appropriate location.
- 2) On line sampling - A product is automatically manufactured, however, it's testing procedures involve lengthy laboratory tests, such as in the pharmaceutical industry and other process industries. Obviously 100% testing is not practical and some form of sampling is necessary. This demands some person to collect samples to be taken to the laboratory. This is done in a sporadic fashion by some laboratory personnel, since this task is dull and non-productive. This results in strata sampling rather than true random sampling. The former method would not detect any malfunction in the process that occurs between strata samples. Or if detected, the malfunction would show up much later than with true random selection of the product to be tested. The percentage of testing can be easily adjusted, making the sampling operation quite flexible. Also continuous monitoring of the process is possible since there are no inactive periods as exist in strata sampling.

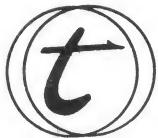
3) All automatic quality control - A product is manufactured for which multiple tests are involved in its quality control operation. Automatic testing equipment is available, but feeding the products directly to the testing machine thus testing 100%, slows down the production significantly. Therefore, automatic random sampling can be used here advantageously for it provides a means to automatically select samples which in turn are fed to the automatic testing machines, thereby making the quality control operation all automatic.

RELIABILITY - ERAC 7000 is a highly reliable device since all load switching is done by solid-state means.

FLEXIBILITY - ERAC 7000 is easily adapted to any type of random sampling, whether the product sampled is a lot of stampings or a liquid. The percentage of selection is adjustable.

GUARANTEE - Trag Automatic Systems will service, free of charge, any defective units within one year after date of purchase if the control system has been used within the ratings specified, and no misuse or abnormal condition has been subjected to the instrument.

SPECIAL SYSTEMS - Special systems can be custom designed by Trag Automatic Systems. Please send your requirements for quotation.



# RANDOM NUMBER GENERATOR

model D-10

ERAC 7000 generates random numbers in digital form.

Unlike presently used subroutines which generate pseudo-random numbers by using a pre-programmed mathematical approach, ERAC 7000 electronically generates true random numbers. Therefore, the errors introduced by pseudo-random numbers are avoided and a savings in memory space results by the elimination of the sub-routine.

GENERAL CHARACTERISTICS

- Maximum clock frequency: 100 KC
- Word length: 10 bit parallel
- Electrically independent bit unit
- Self contained power supply, highly filtered to block periodic components

LOGIC Positive or negative logic available. Logic levels can be set to be compatible with any existing digital system.

TRIGGERING The triggering can be done externally or by an internal clock.

APPLICATIONS

- Statistical Studies
- Simulation of Random Events
- Monte Carlo Techniques
- Data Sampling

PRICE Effective January 1966

Model D-10 \$2,780. F.O.B. Detroit

GUARANTEE

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SPECIAL SYSTEMS

Special systems can be custom designed by TRAG AUTOMATIC SYSTEMS. Models with more than 10 bit word length are available on special order. Please send your requirements for quotations.